

Microgravity

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Use of the NBL Simulator : Classroom Activity

Summary

This activity demonstrates the concepts of neutral buoyancy and microgravity. It allows students to compare the experiences of completing a task in normal Earth-gravity to those of microgravity environment through simulation.

Notes:

The NBL Simulator works best when filled with fluid (water, glycerin, or clear soap). For the task completion activity, it is best to use objects that are large enough to be seen from a distance and are brightly colored. Two plastic spoon heads, removed from the spoon handles and then taped together, work well as a neutrally buoyant object (see diagram).



Build the Simulator!

[Click here for instructions on building the **classroom version** of the NBL Simulator.](#)

[Click here for instructions on building the **aquarium version** of the NBL Simulator. The aquarium version is higher in quality, but also higher in cost.](#)

Step 1

Select a volunteer.

Step 2

Have the volunteer slip his/her hands inside a pair of gloves identical to the pair attached to the NBL Simulator. Using activities set up on a table, have the volunteer perform the task of sorting colored objects and placing them into zip-lock bags according to color. Time the activity.

Step 3

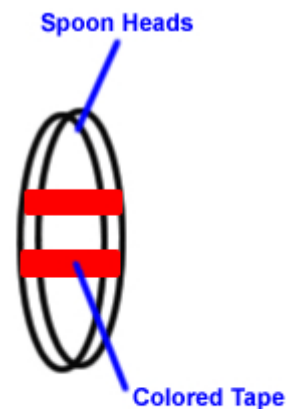
Next have the volunteer do the same task within the NBL Simulator and time the activity. Discuss whether it is easier or harder to work in microgravity and why this might be the case.

Option 1

Construct an NBL Simulator with gloves on both sides and have two students cooperate to perform tasks.

Option 2

Although not always at neutrally buoyant, interlocking colored building blocks and other construction toys can be used to develop more detailed tasks.



Allowing water to enter between the two spoon heads will keep them from floating.

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Construct the NBL Simulator! (Classroom Version)

Summary

This device mimics conditions in NASA's Sonny Carter Training Facility/Neutral Buoyancy Laboratory in Houston, Texas. Note: The classroom NBL Simulator will be filled with fluid, so it is essential that all seals be made watertight. See the [Aquarium Version](#) for a better quality device (but higher cost).



Materials

Estimated Cost: \$50 - \$75. Construction costs do not include toys or objects to be used in tasks and activities.

- (1) 15 to 30 gallon clear plastic tub
- (4) Zip ties or (2) hose clamps
- (2) Stanley Super Chem 12-Inch Gloves or Elbow Length Gauntlet Cuff gloves (or equivalent chemically resistant, long, rigid gloves)
- (2) PVC pipes, 4" to 6" diameter, 4" long, 1/8" to 1/4" thick
- silicone sealer
- Plastic Weld
- Sufficient water, glycerin, or clear liquid soap to almost fill the plastic container

Step 1

Cut two 5" diameter holes in one side of the clear box using a Dremel too or 5" hole saw. Holes will be used as ports for the gloves and should be side by side, but spaced far enough apart to allow the user to clasp their hands normally, etc. once the gloves are attached.

Note: When placing arm holes, keep the shorter arm length of students in mind.

Step 2

Insert the two PVC pipes into the holes. The fit should be tight. Leave at least two inches sticking out on the exterior of the box. Secure with silicone sealer and/or plastic weld.

Step 3

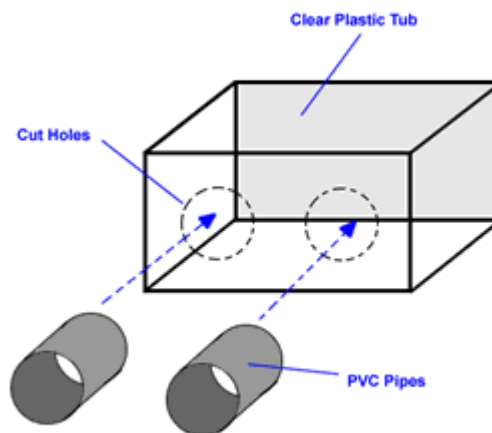
Lay down a thin bead of silicone around each PVC pipe on the inside of the box where the gloves will contact them. Fold a cuff on the sleeve of each glove and slide them onto the PVC pipes- it should be a snug fit.

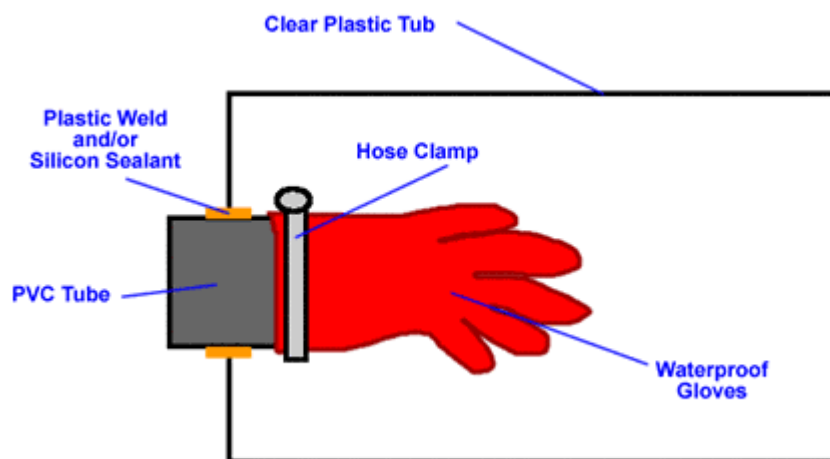
Step 4

Attach zip ties or hose clamps around the gloves and PVC pipes on the inside of the box and cinch down to seal.

Step 5

Seal any gaps or folds in the gloves with silicone. Let entire assembly dry for 24 hours. Test seals before filling with water.





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Construct the NBL Simulator! (Aquarium Version)

Summary

This device mimics conditions in NASA's Sonny Carter Training Facility/Neutral Buoyancy Laboratory in Houston, Texas. Note: The aquarium version of the NBL Simulator will be filled with fluid, so it is essential that all seals be made watertight.



Materials

Estimated Cost: \$150 - \$200.= Construction costs do not include toys or objects to be used in tasks and activities.

- (1) 15 to 30 gallon clear acrylic aquarium
- (4) Zip ties or (2) hose clamps
- (2) Stanley Super Chem chemical resistant gloves (very rigid)
- (4) pieces of acrylic, 3" x 17", 1/8" thick to make sleeves from
- Aquarium cement
- Silicone sealer

NOTE: water, clear liquid soap, or a glycerin-water combo are good fluids to use inside the Simulator.

Step 1

Cut circular holes in one side of the aquarium using a 5" hole saw (these holes are arm holes so space them for comfort)

Step 2

Outer Sleeves: Bend the two 3"x17"x1/8" pieces of acrylic into cylinders to make the sleeves (or tubes), place them into the arm holes (trim them for exact fit). A hair dryer can be used to heat the acrylic and make it easier to bend. Use aquarium cement to secure, both inside and outside, wherever the sleeves contact the aquarium walls.

Step 3

When aquarium cement is dry, seal the cement seams with a thin bead of silicone. Allow to dry.

Step 4

Insert the gloves through the sleeves and fold a cuff around the outside of each glove for a tight fit. Secure the gloves with two zip ties each (or 1 hose clamp each) on the outside of the aquarium - clamping the cuffed gloves against the sleeves.

Step 5

Inner Sleeves: Bend the remaining 2 3"x17"x1/8" pieces of acrylic into cylinders to form inner sleeves. These cylinders will fit inside the first set of tubes. Trim for an exact fit. Apply a bead of silicone between the gloves and the outer sleeves. Then slide the additional acrylic sleeves inside the gloves, and seal with aquarium cement and silicone as before.

Step 6

Allow 24 hours to dry. Test seals before filling with water.

